

Color expressing method, color image reading apparatus and color image processing apparatus.

Patent Number: EP0523898
Publication date: 1993-01-20
Inventor(s): KAWAI TAKASHI (JP); USAMI AKIHIRO (JP)
Applicant(s): CANON KK (JP)
Requested Patent: ☐ EP0523898, B1
Application Number: EP19920306236 19920707
Priority Number(s): JP19920000111 19920106; JP19910167037 19910708
IPC Classification: H04N1/46
EC Classification: H04N1/60
Equivalents: DE69229084D, DE69229084T, ☐ US5422739

Abstract

A color image processing apparatus comprising image input means for inputting at least a target image, image processing means for performing predetermined image processing of an input image signal, and image output means for outputting the processed image signal to another color image processing apparatus or color image recording apparatus. The image signals input and output from said image input means and said image output means are color-separated signals obtained by color-separating a beam from the target image into predetermined colors. The color-separated signals are expressed by a combination of data of reference stimuli represented by vertices of a triangle substantially circumscribing a spectral locus of a color

degree diagram. 

Data supplied from the esp@cenet database - I2

(19)



W. H. 8904
Europäisches Patentamt
European Patent Office
Office européen des brevets



(11)

EP 0 523 898 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:
06.05.1999 Bulletin 1999/18

(51) Int Cl.⁶: **H04N 1/46**

(21) Application number: **92306236.8**

(22) Date of filing: **07.07.1992**

(54) **Color expressing method, color image reading apparatus and color image processing apparatus**

Farbvorstellungsverfahren, Farbbildlesegerät und Farbbildverarbeitungsgerät

Procédé d'expression de couleurs, appareil de lecture d'images en couleurs et appareil de traitement d'images en couleurs

(84) Designated Contracting States:
DE ES FR GB IT NL

(30) Priority: **08.07.1991 JP 167037/91**
06.01.1992 JP 111/92

(43) Date of publication of application:
20.01.1993 Bulletin 1993/03

(73) Proprietor: **CANON KABUSHIKI KAISHA**
Tokyo (JP)

(72) Inventors:
• **Usami, Akihiro, c/o Canon Kabushiki Kaisha**
Ohta-ku, Tokyo (JP)
• **Kawai, Takashi, c/o Canon Kabushiki Kaisha**
Ohta-ku, Tokyo (JP)

(74) Representative:
Beresford, Keith Denis Lewis et al
BERESFORD & Co.
2-5 Warwick Court
High Holborn
London WC1R 5DJ (GB)

(56) References cited:
EP-A- 0 203 448 **WO-A-80/00753**
US-A- 4 965 663

- **Book no. , 1986, 'TELEVISION ENGINEERING HANDBOOK', K.B BENSON MCGRAW-HILL, NEW YORK**
- **Book no. , 1975, 'THE REPRODUCTION OF COLOUR', R.W.G. HUNT FOUNTAIN PRESS, ENGLAND**

Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

EP 0 523 898 B1

Description

BACKGROUND OF THE INVENTIONField of the Invention

[0001] The present invention relates to a color expressing method, a color image reading apparatus, and a color image processing apparatus.

[0002] For example, a conventional color expressing method in a color image reading apparatus adopts a color system of R, G, and B signals determined by, e.g., an NTSC scheme and represented by R, G, and B in Fig. 6 as spectral sensitivity of a tricolor separation system. The color system is determined in accordance with the color emission characteristics of R, G, and B phosphor materials of a cathode-ray tube as coloring materials used in a television receiver. A method using the spectral sensitivity in the XYZ colorimetric system of the CIE (Commission Internationale de l'Eclairage) or a tricolor separation system having a narrow-band (narrow band width) spectral sensitivity for measuring the Y (yellow), M (magenta), and C (cyan) densities of inks or colorants used in an original (transmission or reflection) has been used.

[0003] In the prior art described above, since marks representing R, G, and B chromaticity values or color degrees are plotted within a spectral locus, as shown in Fig. 6, the spectral sensitivity characteristics of the tricolor separation system used in a color image reading apparatus for generating R, G, and B signals which satisfy these chromaticity values must have a theoretically negative region, as shown in Fig. 7. However, the spectral sensitivity characteristics having a negative region cannot be realized in practice. The spectral sensitivity characteristics are therefore approximated by spectral correction (i.e., the negative region is eliminated or correction is performed as indicated by broken lines), as shown in Fig. 8, or corrected in accordance with linear conversion. However, with this method, the color characteristics of a target original or an object are read with a large amount of errors. Even if the color characteristics are accurately read, colors plotted outside the triangle defined by chromaticity values of color components emitted from the above-described phosphor materials such as colors represented by marks \bar{x} in Fig. 9 have negative signal values. This phenomenon causes a difficulty in processing signals. If each negative signal is set to be "0", the corresponding color cannot be expressed, resulting in inconvenience.

[0004] In use of a color expressing method of the XYZ colorimetric system of the CIE, signal values read for expressing colors along the x- and y-axes in the color degree diagram or chromaticity diagram in Fig. 6 are not negative. The spectral sensitivities for realizing the XYZ colorimetric system for realizing the above color expressing method are as shown in Fig. 10 (the signal values are normalized with maximum sensitivity values). As is apparent from Fig. 10, since the full-width at half maximum of the \bar{y} spectral sensitivity for forming a Y signal is wide, filters having different spectral transmittances must be combined to satisfy this spectral sensitivity. Digital values of the X, Y, and Z signals cover a wide region on the color degree diagram, and nonexistent colors are also assigned with signal values. The number of effective data becomes only about 65% of all data to be quantized (Fig. 14). Fig. 14 shows chromaticity points obtained when X, Y, and Z signals are quantized with six levels. It is apparent that chromaticity points outside the spectral locus are present, thus resulting in inefficient signal value utilization.

[0005] In a chromaticity meter using a narrow-band spectral filter used in printing equipment, the color separation characteristics of an object such as a color picture are poor except when the spectral characteristics of inks and the like used in an original are already known.

[0006] For example, in a system such as a digital color copying machine integrally including a color image reading apparatus, a color image processing apparatus, and a color image outputting apparatus, a unique color data expressing method is used for operations from color image inputs to color image outputs in accordance with the spectral sensitivity characteristics of a tricolor separation system and the spectral characteristics of inks and colorants.

[0007] In a color image reading apparatus such as a color image reader, read signals are obtained using a color data expressing method depending on the spectral sensitivity characteristics of a tricolor separation system used in this apparatus. Similarly, in a color image outputting apparatus such as a color printer of an ink-jet or thermal transfer system, colors expressed by input signals vary depending on the types of color printers. That is, a color data expressing method unique to each printer is employed.

[0008] As described above, in a color monitor such as a color television receiver, an RGB color data expressing method complying with the NTSC standards shown in Fig. 4, as described above, is employed in Japan. This color data expressing method is determined in accordance with the color characteristics of the CRT R, G, and B phosphor materials serving as coloring materials used in the television receiver.

[0009] As in the digital color copying machine described above, however, when the color image reading apparatus, the color image processing apparatus, and the color image outputting apparatus employ different color expressing methods suitable therefor, in order to cause the color image processing apparatus to process color data read by the color image reading apparatus and cause the color image outputting apparatus to output the processed color data,

conversion operations must be repeated to obtain data suitable for each color expressing method of each apparatus due to differences in spectral sensitivity distributions and spectral characteristics of the apparatuses, resulting in inconvenience.

[0010] "The Reproduction of Colours" by R.W.G. Hunt, published by Fountain Press in England 1975, pages 70-95, discloses the Ivs-Abney-Yule compromise.

[0011] The Television Engineering Handbook, edited by K. Blair Benson and published by McGraw-Hill, 1986, discloses the basic concepts of color vision and color matching.

[0012] U.S. Patent Specification No. US-A-4,965,663, European Patent Specification EP-A-0,203,448 and International Patent Specification WO-A-8000753 all disclose the use of X, Y, Z color space in color processing.

[0013] It is a concern of the present invention to provide a color expressing method and apparatus which can solve the conventional problems described above.

[0014] In accordance with a first aspect of the present invention there is provided a color processing method as set out in claim 1.

[0015] In accordance with a second aspect of the present invention there is provided color processing apparatus as set out in claim 4.

[0016] An embodiment of the present invention provides a color image reading apparatus capable of processing color image data independently of the color characteristics of devices of a plurality of apparatuses.

[0017] Another embodiment of the present invention provides a color image reading apparatus capable of obtaining color image data expressed by a color expressing method having a wide color expression range by using a color filter which can be easily manufactured.

[0018] The above and other features and advantages of the present invention will be described by way of example in the following detailed description of preferred embodiments which is given in conjunction with the accompanying drawings, in which:

Fig. 1 is a graph showing the spectral sensitivities according to an embodiment of the present invention;
 Fig. 2 is a color degree diagram showing reference stimuli according to the embodiment shown in Fig. 1;
 Fig. 3 is a graph showing the spectral sensitivities of a filter used in an image reading apparatus according to the embodiment shown in Fig. 1;
 Fig. 4 is a sectional view showing an arrangement of an image reading apparatus of the embodiment shown in Fig. 1;
 Fig. 5 is a block diagram of a circuit of the embodiment shown in Fig. 1;
 Fig. 6 is a color degree diagram for explaining a conventional example;
 Fig. 7 is a graph showing the spectral sensitivities for explaining the conventional example;
 Fig. 8 is a graph showing the spectral sensitivities used in an image reading apparatus used in a conventional apparatus;
 Fig. 9 is a color degree diagram for explaining the conventional example shown in Fig. 6;
 Fig. 10 is a graph showing the spectral sensitivities of another conventional example;
 Fig. 11 is a block diagram of an image processing apparatus according to another embodiment of the present invention;
 Figs. 12A and 12B are other color degree diagrams of the embodiment shown in Fig. 1;
 Figs. 13A and 13B are still other color degree diagrams of the embodiment shown in Fig. 1;
 Fig. 14 is a color degree diagram expressed by using the conventional XYZ colorimetric system;
 Fig. 15 is another color degree diagram expressed by using the conventional XYZ colorimetric system; and
 Fig. 16 is a block diagram showing an arrangement according to another embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0019] In a color expressing method according to the first embodiment of the present invention, three x positions in Fig. 2 are defined as reference stimuli represented as follows in the xy coordinate system:

(1.07423, 0.42295)
 (0.01179, 0.86921)
 (-0.02358, -0.08679)

[0020] A triangle obtained by connecting these three points circumscribes a spectral locus of the xy color degree diagram substantially at 505 nm and 525 nm and overlaps a pure purple locus obtained by connecting 380- and 780-nm points.

[0021] The spectral sensitivity characteristics for generating these reference stimuli are given as characteristics

shown in Fig. 3 (normalized with maximum sensitivity values).

[0022] Referring to Fig. 3, a red spectral sensitivity has a small sensitivity peak in a blue region. A wavelength at a maximum peak value of this small peak almost coincides with a maximum sensitivity wavelength (about 445 nm) of the blue spectral sensitivity peak in a red region. A wavelength at a maximum peak value of this small peak almost coincides with a maximum sensitivity wavelength (about 600 nm) of the red spectral sensitivity.

[0023] In view of the above, the blue region in the red spectral sensitivity can be substituted with the blue spectral sensitivity. Similarly, the red region in the blue spectral sensitivity can be substituted with the red spectral sensitivity. R, G, and B signals output from a color sensor are processed to correct the spectral sensitivities. The blue region in the red spectral sensitivity and the red region in the blue spectral sensitivity are eliminated to obtain the graph shown in Fig. 1.

[0024] Since the spectral sensitivities in Fig. 1 have smaller full-widths at half maximum than those of the spectral sensitivities in Fig. 8, they can be relatively easily obtained by using dyes, pigments, and glass infrared cut filters.

[0025] A color image reading apparatus having image pickup characteristics of the spectral sensitivities in Fig. 1 is shown in Fig. 4. The color image reading apparatus comprises an original glass table 2 on which an original 1 is to be placed, an original illumination unit 3, a short-focus lens array 4, a linear color solid-state image pickup element array 5 having the spectral characteristics shown in Fig. 1, and an optical unit 6. The solid-state image pickup element array 5 electrically scans the original 1 in a main scanning direction. That is, the optical unit 6 scans the original 1 in a direction indicated by an arrow. The original illumination unit 3 illuminates the original 1 placed on the original glass table 2. Light reflected by the original 1 is focused on the color solid-stage image pickup element array 5 through the short-focus lens array 4. An original image focused on the color solid-stage image pickup element array 5 is converted into R, G, and B electrical signals by the image pickup element array 5.

[0026] Fig. 5 is a block diagram showing a circuit for processing the signals output from the color solid-state image pickup element array 5 shown in Fig. 4. The R, G, and B signals as analog signals are converted into digital signals by an A/D converter 7. A shading circuit 8 corrects variations in sensitivities of the color solid-state image pickup element array 5 and variations in illuminance of the original illumination unit 3. A 3 x 3 matrix operation unit 9 performs a matrix operation. The conversion matrix is represented as follows (in this case, since the R, G, and B signals are corrected by the shading circuit 8, they are normalized as $R' = G' = B' = 1$ if these input signals are given as $R = G = B = 1$):

$$\begin{bmatrix} R' \\ G' \\ B' \end{bmatrix} = \begin{bmatrix} 0.83456 & -0.01261 & 0.17805 \\ 0.00000 & 1.00000 & 0.00000 \\ 0.28673 & -0.04576 & 0.75903 \end{bmatrix} \begin{bmatrix} R \\ G \\ B \end{bmatrix} \quad \dots (1)$$

[0027] By this operation, the R, G, and B signals can be converted as if the R, G, and B signals are read using the spectral sensitivities shown in Fig. 3. When coefficients of matrix (1) in the matrix operation unit 9 are changed as follows, reference stimuli can be converted as shown in Fig. 13B:

$$\begin{bmatrix} R' \\ G' \\ B' \end{bmatrix} = \begin{bmatrix} 0.88468 & 0.05105 & 0.06427 \\ 0 & 1 & 0 \\ 0.00050 & 0.03968 & 0.95982 \end{bmatrix} \begin{bmatrix} R \\ G \\ B \end{bmatrix} \quad \dots (2)$$

[0028] This color expressing method in Fig. 13B allows more effective signal utilization than the XYZ colorimetric system. This more effective signal utilization can be shown in Fig. 15. The number of effective data can be up to about 89% of all data to be quantized and is thus larger than that of the XYZ colorimetric system. Chromaticity points (a), (b), and (c) (Fig. 15) satisfying conditions $R = G$, $B = 0$, $G = B$, $R = 0$, $R = G$, and $B = 0$ have relatively large numbers of data due to the nature of digital data. When these chromaticity points are plotted on the spectral locus or the pure purple locus, effective data utilization can be further assured. In Fig. 15, these chromaticity points are located at 490- and 573-nm points and on the pure purple locus. Basic stimuli in Fig. 15 are equi-energy spectra. If other basic stimuli (e.g., D_{65} or a C light source) are used, the chromaticity points (a), (b), and (c) are slightly shifted, but can be plotted near positions in Fig. 13B.

[0029] In this embodiment, the reference stimuli are set to be circumscribed at almost the 505- and 525-nm points in Fig. 2. However, the reference stimuli may be circumscribed in the ranges of 480 nm to 510 nm and 520 nm to 570

nm. In this case, spectral characteristics obtained by removing the blue and red components, respectively, from the red and blue spectral sensitivities are used and the removed components are added in the 3 x 3 matrix operation as in the above embodiment.

[0030] The basic stimuli of an illumination light source, an observation light source, or the like used in the reading apparatus shown in Fig. 4 may be equal-energy spectra or may be generated by a light source such as D₆₅, a C light source, or D₅₀ standardized by the CIE.

[0031] A color reproduction region can be increased when filter spectral sensitivities have spectral sensitivity obtained in consideration of the spectral energy distribution of a light source (e.g., D₆₅ or a C light source). For this purpose, characteristics represented by a weighting function and obtained by multiplying the spectral energy distribution of the light source in units of wavelengths with the spectral sensitivities in Fig. 1 are used as the total spectral sensitivities of a system including an illumination light source of the reading apparatus. In this case, if the total spectral sensitivities are set to coincide with the weighting function, any light source other than D₆₅ and a C light source may also be used.

[0032] R, G and B signals read in accordance with the spectral sensitivities in Fig. 1 may be converted into NTSC or HDTV color signals in accordance with the matrix operation. In this case, a matrix is arranged to convert the above reference and basic stimuli (e.g., equi-energy spectra) into reference and basic stimuli of the NTSC or HDTV scheme. This conversion is performed in a converter 10 in Fig. 5.

[0033] Conversion into NTSC (conversion to HDTV will be omitted since matrix coefficients can be similarly obtained with only the reference and basic stimuli of the HDTV scheme being different from those of the NTSC scheme):

$$\begin{bmatrix} 1.6351 & -0.4713 & -0.0750 \\ -0.2503 & 1.4329 & -0.1962 \\ 0.0148 & -0.0848 & 0.9073 \end{bmatrix} \dots (3)$$

[0034] The matrix operation unit 9 in Fig. 5 may perform the operation of matrix (2) and the converter 10 may perform an operation of matrix (3). However, the stimulus value conversion matrix (3) may be multiplied with matrix (2) to use matrix (4) as coefficients in the matrix operation in Fig. 5:

$$\begin{bmatrix} R' \\ G' \\ B' \end{bmatrix} = \begin{bmatrix} 1.4465 & -0.3908 & 0.0331 \\ -0.2216 & 1.4124 & -0.2044 \\ 0.0136 & -0.0481 & 0.8718 \end{bmatrix} \begin{bmatrix} R \\ G \\ B \end{bmatrix} \dots (4)$$

[0035] When the gamma characteristics of the monitor are taken into consideration, each resultant value is multiplied with 0.45.

[0036] XYZ stimulus values of the CIE can be converted by the above stimulus value conversion matrix. If the XYZ stimulus values are obtained, processing using mathematical expressions can be performed in the converter 10 in Fig. 5 to obtain xyY and L*A*B* stimulus values.

[0037] Fig. 11 shows an image processing apparatus according to another embodiment of the present invention. The same reference numerals as in Fig. 5 denote the same parts in Fig. 11, and a detailed description thereof will be omitted.

[0038] The image processing apparatus shown in Fig. 11 comprises a complementary color converter 100 for converting R, G, and B color signals into Y, M, and C (yellow, magenta, and cyan) complementary color signals, and a masking UCR 110 for correcting color mixture components of the colorants used in a color printer 120 with respect to the Y, M, and C signals and for performing undercolor removal and inking. The color printer 120 may be an electro-photographic, ink-jet, or any other printer.

[0039] According to the embodiment shown in Fig. 11, since accurate color data are obtained, color reproducibility in the color printer can be improved.

[0040] The above embodiment exemplifies an image reading apparatus having a flat bed shown in Fig. 4. However, a video camera, a still video camera, or the like may be used as an image input apparatus, as a matter of course.

[0041] In the above embodiment, a color is expressed by a combination of reference stimulus data representing the vertices of the triangle shown in Fig. 2. However, the present invention is not limited to this. For example, a color may be expressed by a combination of reference stimulus data representing the vertices of a triangle shown in each of Figs. 12B and 13B. In addition, the color degree diagram is obtained by utilizing an equi-color function having a two-degree

viewfield. However, an equi-color function having a ten-degree viewfield may be used. Alternatively, RGB equi-color functions proposed by Guild and Wright may be used, or a color degree diagram obtained from any other equi-color function may be used.

[0042] Figs. 12A and 13A show the spectral sensitivity characteristics for obtaining reference stimuli in Figs. 12B and 13B, respectively.

[0043] As described above, according to the above embodiments, a color expressing method having image pickup characteristics as practical spectral sensitivities having reference stimuli at the vertices of a triangle circumscribing a spectral locus of the color degree diagram to effectively utilize signal values is employed so as to improve color reproducibility and allow effective utilization of signals while preventing the signal values from being negative.

[0044] According to these embodiments, simple, accurate color expression can be performed.

[0045] Fig. 16 is a block diagram showing an arrangement according to still another embodiment of the present invention.

[0046] An image processing apparatus shown in Fig. 16 mainly comprises a color image input apparatus 101 for receiving or generating a color image, a color image processing apparatus 102 for performing various image processing operations (e.g., color conversion, image synthesis, and image analysis) of the input color image, and a color image outputting apparatus 103 for displaying the color image on a monitor or printing and recording the color image.

[0047] Each apparatus has various types of devices in accordance with the formats of input/output images and processing contents. For example, the color image input apparatus 101 comprises a color image scanner 1011 for reading color-separated signals of light reflected by a printed matter placed on an original table as read signals, a color copying machine reader 1012, a still video camera 1013 for reading a natural scene such as a scenery as a color still image, a computer 1014 for forming a color image such as a computer graphic (CG) image, and a film scanner 1015 for reading an image from a silver chloride film. Since these devices input and generate a color image and perform predetermined color processing, color data 104 is output to the color image processing apparatus 102 (to be described in detail below).

[0048] The color image processing apparatus 102 comprises a computer 1021 for performing color conversion, image synthesis, and image analysis, a color copying machine processing unit 1022, and an image buffer memory 1023. The color data 104 sent from the color image input apparatus 101 is input to the color image processing apparatus 102, and the color image processing apparatus 102 performs predetermined image processing on the basis of the color data 104, thereby outputting image data.

[0049] The color image processing apparatus 102 performs data transfer operations as data transfer between the image processing devices corresponding to the processing contents in the color image processing apparatus 102. These data transfer operations are data transfer (corresponding data serves as transfer data 106) between the computer 1021 and the color copying machine processing unit 1022, data transfer (transfer data 107) between the color copying machine processing unit 1022 and the image buffer memory 1023, and data transfer (transfer data 108) between the computer 1021 and the image buffer memory 1023. The color image converted by the color image processing apparatus 102 is sent as color data 105 to the color image outputting apparatus 103. The image data 105 is output from the color image outputting apparatus 103 in various formats.

[0050] The color image outputting means 103 comprises a color image printer 1031 for printing and recording an image in accordance with an ink-jet, thermal transfer, silver chloride photographic, or electrophotographic scheme, a color copying machine printer unit 1032, a color monitor 1033 for operating RGB phosphors of a cathode-ray tube to display a color image, an image memory disk 1034 (e.g., an optical disk, a magnetic tape, or an optomagnetic disk) for holding color image data, and a film writer 1035 for exposing color light on a color silver chloride film to form a color image thereon.

[0051] The above apparatuses have output and input units (not shown), and formatted data are transferred between the apparatuses through cables (not shown) in accordance with a predetermined data format.

[0052] A data expressing method for standardizing the transfer data 104 to 108 in the apparatus of this embodiment will be described below.

[0053] As a color expressing method of this embodiment, a color expressing method using reference stimuli at predetermined positions represented by marks x in the xy color degree diagram shown in Fig. 13B is used. These reference stimuli are represented in the xy coordinate system as follows:

R: (0.7347, 0.2653)

G: (-0.0860, 1.0860)

B: (0.0957, -0.0314)

[0054] At this time, a triangle obtained by connecting these three points almost circumscribes a spectral locus of the xy color degree diagram, at a point corresponding to a wavelength of 505 nm, and a point corresponding to a wavelength of 525 nm. In addition, the triangle overlaps a pure purple locus obtained by connecting a 380-nm point (point A) and

a 780-nm point (point B).

[0055] Fig. 3 shows the spectral sensitivity characteristics for generating the above reference stimuli. The characteristics are normalized with maximum sensitivity values.

[0056] As described above, according to this embodiment, a color expressing method of color input/output data in the color image input and outputting apparatuses and the color image processing apparatus is obtained as a color expressing method using signals which maximally suppresses chromaticity values outside the spectral locus, i.e., nonexistent colors in such a manner that the reference stimuli at the vertices of the triangle circumscribing the spectral locus of the color degree diagram are used to include the spectral locus of the color degree diagram in the color space. Therefore, the color data can be transferred between the apparatuses in the same color space, color space conversion processing circuits can be omitted.

[0057] The color data signals can be efficiently processed between the respective apparatuses, and color reproducibility can be improved.

[0058] The present invention is applicable to a system constituted by a plurality of equipments or an apparatus consisting of one equipment. The present invention is also applicable to an arrangement in which a program is supplied to a system or apparatus, as a matter of course.

[0059] As described above, according to this embodiment, a color expression which maximally eliminate nonexistent colors by including the spectral locus on the color degree diagram in the color space is employed. Therefore, color data can be transferred within the same color space and color reproducibility can be improved.

Claims

1. A color processing method comprising the steps of: inputting a color image signal; characterised by

converting the input color image signal into a digital signal expressed by a combination of data of reference stimuli represented by color coordinates in the CIE 1931 xy coordinate system, in which said color coordinates of the reference stimuli are:

$R=(0.7347, 0.2653),$
 $G=(-0.0860, 1.0860)$ and
 $B=(0.0957, -0.0314);$

and

outputting the digital signal to either a color image processing apparatus or a color recording apparatus.

2. A method according to claim 1, and including A/D converting the output of an image pickup device and utilising shading means (8) for correcting the output of the A/D converting means.

3. A method according to claim 1 or claim 2, and wherein the converted R, G, B signals are converted (100) into Y, M, C complementary signals, masked by masking means (VCR 116) which carries out undercolour removal in accordance with the colorants used by a printer (120), and supplied to the printer so as to record a colour image.

4. Color processing apparatus comprising:

means for inputting a color image signal;

means (10) for converting into an output signal for supply to either a color image processing apparatus or a color recording apparatus;

characterised in that

the converting means are adapted to convert the input color image signal into a digital signal expressed by a combination of data of reference stimuli represented by color coordinates in the CIE 1931 xy coordinate system, in which said color coordinates of the reference stimuli are:

$R=(0.7347, 0.2653),$
 $G=(-0.0860, 1.0860)$ and
 $B=(0.0957, -0.0314).$

5. Apparatus according to claim 4, and including A/D converting means (7) for the output of an image pickup device, and shading means (8) for correcting the output of the A/D converting means.
6. Apparatus according to claim 4 or claim 5, and including means (100) whereby the R, G, B signals representative of the xy coordinate system are converted into Y, M, C complementary signals, and masking means (VCR 116) adapted to carry out undercolour removal on the said Y, M, C complementary signals in accordance with the colorants to be used by a printer (120).

Patentansprüche

1. Farbverarbeitungsverfahren mit den Schritten:

Eingeben eines Farbbildsignals,

gekennzeichnet durch

Umwandeln des eingegebenen Farbbildsignals in ein digitales Signal, das durch eine Kombination von Daten von Bezugsstimuli ausgedrückt wird, die von Farbkordinaten in dem CIE 1931 xy-Koordinatensystem repräsentiert werden, wobei die Farbkordinaten der Bezugsstimuli gegeben sind durch:

$$\begin{aligned} R &= (0.7347, 0.2653), \\ G &= (-0.0860, 1.0860) \text{ und} \\ B &= (0.0957, -0.0314), \end{aligned}$$

und Ausgeben des digitalen Signals zu einem Farbbildverarbeitungsgerät oder zu einem Farbaufzeichnungsgerät.

2. Verfahren nach Anspruch 1, mit

einer A/D-Wandlung der Ausgabe einer Bildaufnahmeverrichtung, wobei eine Schattierungseinrichtung (8) zur Korrektur der Ausgabe der A/D-Wandlungseinrichtung verwendet wird.

3. Verfahren nach einem der Ansprüche 1 oder 2, wobei die umgewandelten R-, G-, B-Signale in Y-, M-, C-Komplementärsignale umgewandelt werden, die von einer Maskiereinrichtung (VCR 116) maskiert werden, die eine Farbrücknahme in Übereinstimmung mit den von einem Drucker (120) verwendeten Färbemitteln durchführt, und die dem Drucker zugeführt werden, um ein Farbbild aufzuzeichnen.

4. Farbverarbeitungsgerät mit:

einer Einrichtung zum Eingeben eines Farbbildsignals,
einer Einrichtung (10) zum Umwandeln in ein Ausgabesignal zur Zufuhr zu einem Farbbildverarbeitungsgerät oder einem Farbaufzeichnungsgerät,

dadurch gekennzeichnet, daß

die Umwandlungseinrichtung daran angepaßt ist, das eingegebene Farbbildsignal in ein digitales Signal umzuwandeln, das durch eine Kombination von Daten der Bezugsstimuli ausgedrückt wird, die von Farbkordinaten in dem CIE 1931 xy-Koordinatensystem repräsentiert werden, wobei die Farbkordinaten der Bezugsstimuli gegeben sind durch:

$$\begin{aligned} R &= (0.7347, 0.2653), \\ G &= (-0.0860, 1.0860) \text{ und} \\ B &= (0.0957, -0.0314). \end{aligned}$$

5. Gerät nach Anspruch 4, mit

einer A/D-Wandlungseinrichtung für die Ausgabe einer Bildaufnahmeverrichtung, und

mit einer Schattierungseinrichtung (8) zur Korrektur der Ausgabe der A/D-Wandlungseinrichtung.

6. Gerät nach einem der Ansprüche 4 oder 5 mit einer Einrichtung (100), wodurch die das xy-Koordinatensystem repräsentierenden R-, G-, B-Signale in Y-, M-, C-Komplementärsignale umgewandelt werden, und mit einer Mas-
 5 kiereinrichtung (VCR 116), die daran angepaßt ist, eine Farbrücknahme bei den Y-, M-, C-Komplementärsignalen in Übereinstimmung mit den von einem Drucker (120) zu verwendenden Färbemitteln durchzuführen.

Revendications

- 10 1. Procédé de traitement de couleur comprenant les étapes suivantes :

introduction d'un signal d'image en couleurs ;

15 caractérisé par

une conversion du signal d'image en couleurs introduit, en un signal numérique exprimé par une combinaison de données de stimuli de référence représentées par des coordonnées de couleurs dans le système de coordonnées xy CIE 1931, dans lequel lesdites coordonnées de couleurs du stimuli de référence sont :

$$\begin{aligned} R &= (0,7347, 0,2653), \\ G &= (-0,0860, 1,0860) \text{ et} \\ B &= (0,0957, -0,0314) ; \end{aligned}$$

25 et délivrance du signal numérique, soit à un appareil de traitement d'images en couleurs, soit à un appareil d'enregistrement en couleurs.

2. Procédé selon la revendication 1, comportant une conversion A/N de la sortie d'un dispositif de prise de vues et utilisant un moyen (8) de correction de la tache pour corriger la sortie du moyen de conversion A/N.

- 30 3. Procédé selon la revendication 1 ou la revendication 2, et dans lequel les signaux R, G, B convertis sont convertis (100) en signaux complémentaires Y, M, C, masqués par un moyen de masquage (VCR 116) qui effectue une suppression de couleur secondaire en fonction des colorants utilisés par une imprimante (120), et appliqués à l'imprimante de manière à enregistrer une image en couleurs.

- 35 4. Appareil de traitement de couleur comprenant :

un moyen pour l'introduction d'un signal d'image en couleurs ;

un moyen (10) pour la conversion en un signal de sortie destiné à être appliqué, soit à un appareil de traitement d'image en couleurs, soit à un appareil d'enregistrement en couleurs ;

40 caractérisé en ce que

le moyen de conversion est apte à convertir le signal d'image en couleurs introduit, en un signal numérique exprimé par une combinaison de données de stimuli de référence représentées par des coordonnées de couleurs dans le système de coordonnées xy CIE 1931, dans lequel lesdites coordonnées de couleur du stimuli de référence sont :

$$\begin{aligned} R &= (0,7347, 0,2653), \\ G &= (-0,0860, 1,0860) \text{ et} \\ B &= (0,0957, -0,0314). \end{aligned}$$

5. Appareil selon la revendication 4, et comportant un moyen (7) de conversion A/N pour la sortie d'un dispositif de prise de vues, et un moyen (8) de correction de la tache pour corriger la sortie du moyen de conversion A/N.

- 55 6. Appareil selon la revendication 4 ou la revendication 5, et comportant un moyen (100) grâce auquel les signaux R, G, B représentatifs du système de coordonnées xy sont convertis en signaux complémentaires Y, M, C, et un moyen de masquage (VCR 116) apte à effectuer une suppression de couleur secondaire sur lesdits signaux com-

plémentaires Y, M, C en fonction des colorants destinés à être utilisés par une imprimante (120).

5

10

15

20

25

30

35

40

45

50

55

FIG. 1

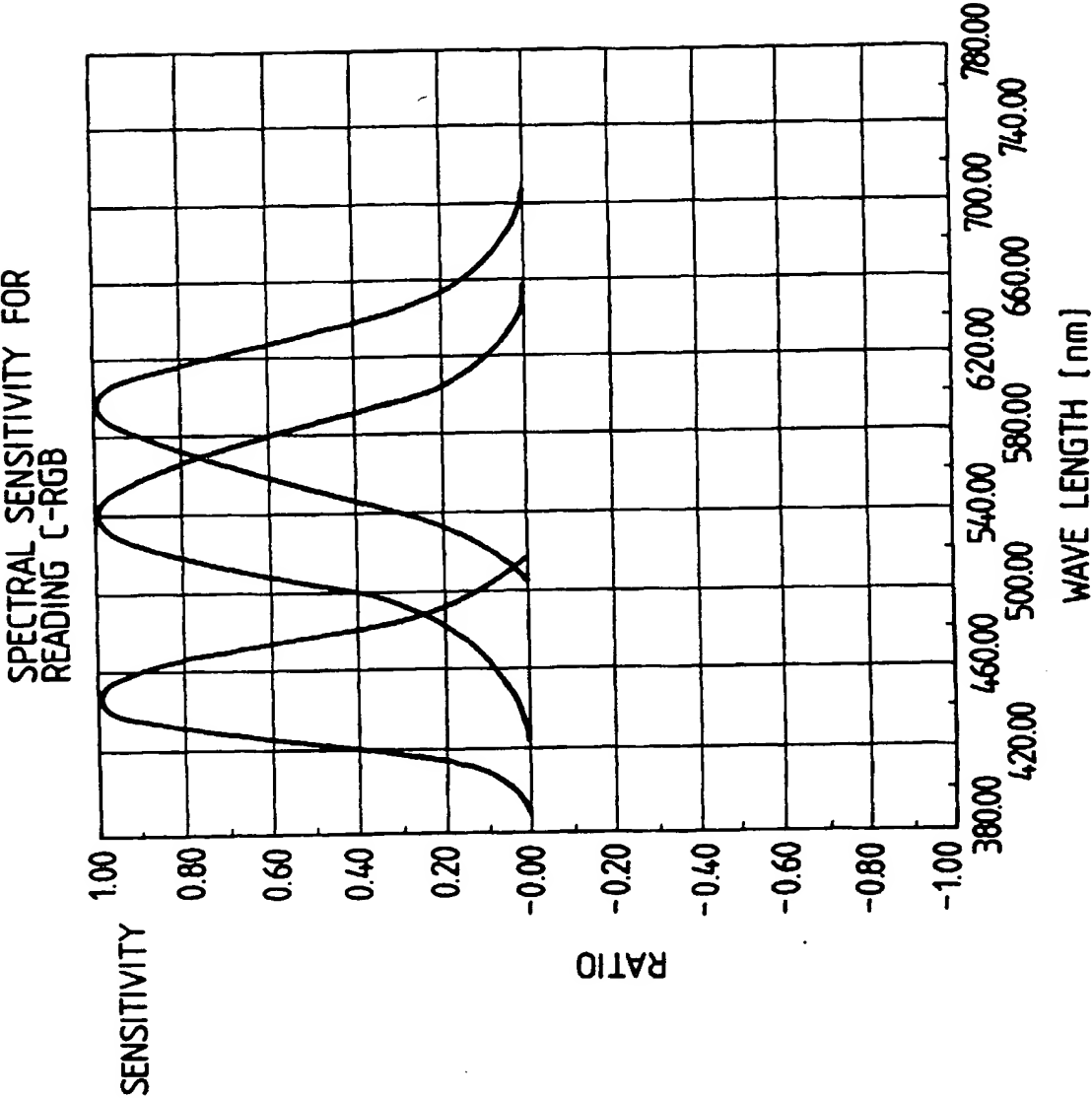


FIG. 2

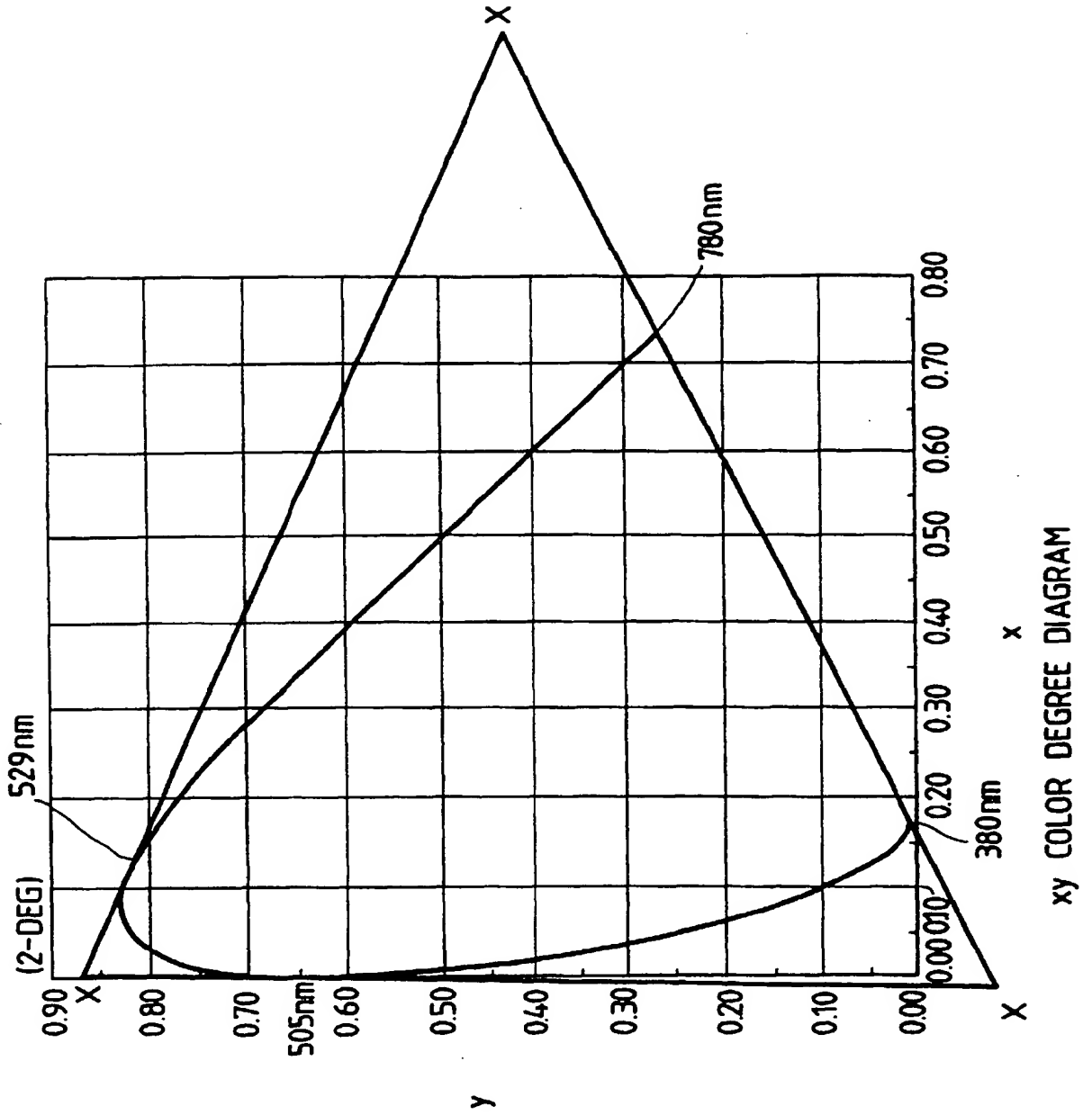


FIG. 3

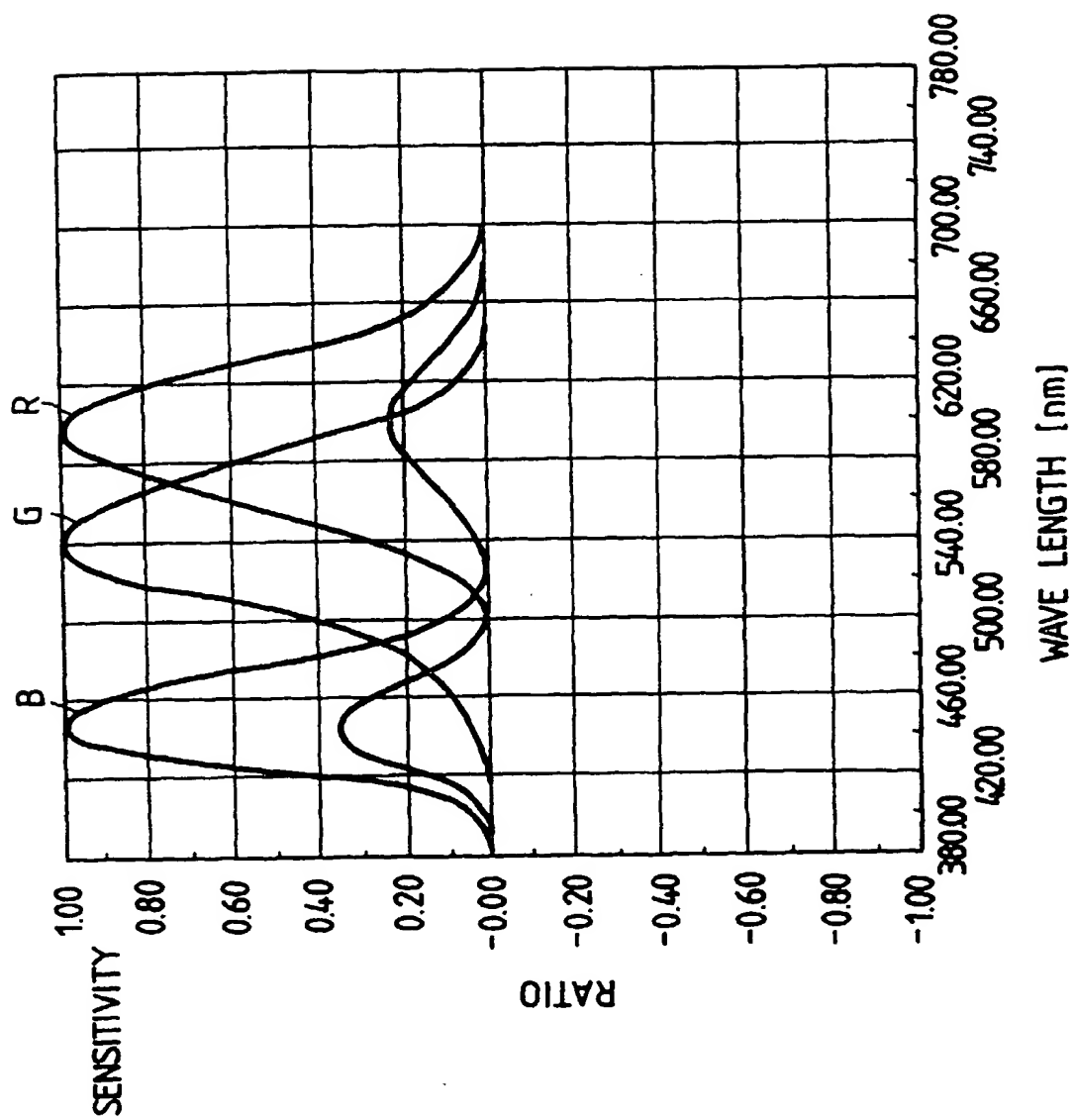


FIG. 4

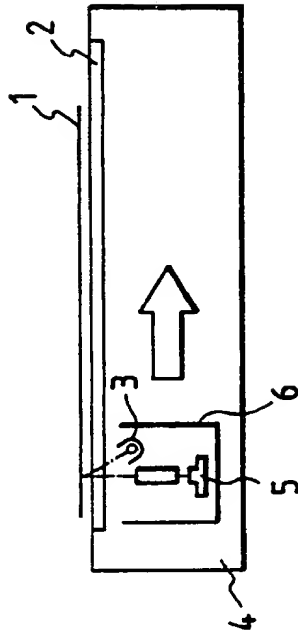


FIG. 5

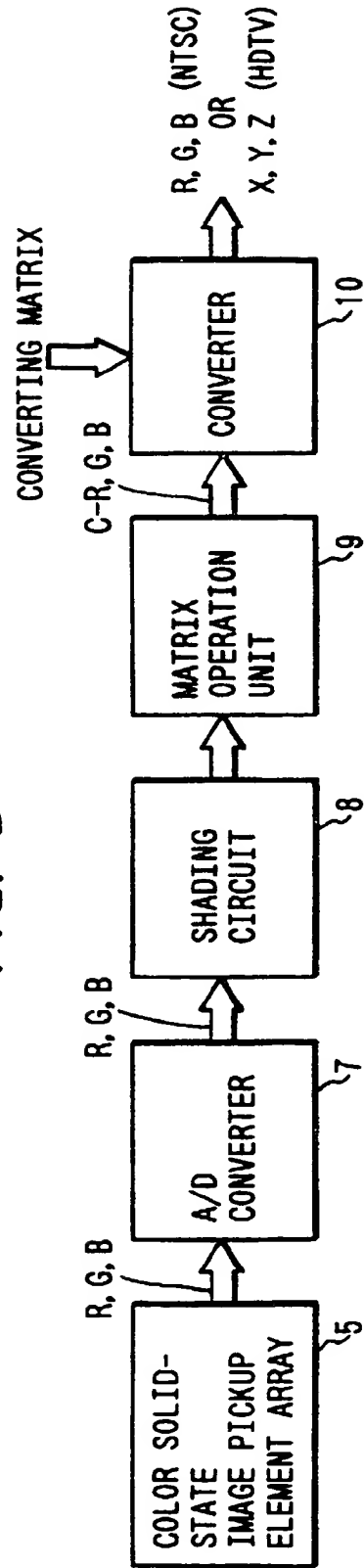


FIG. 6

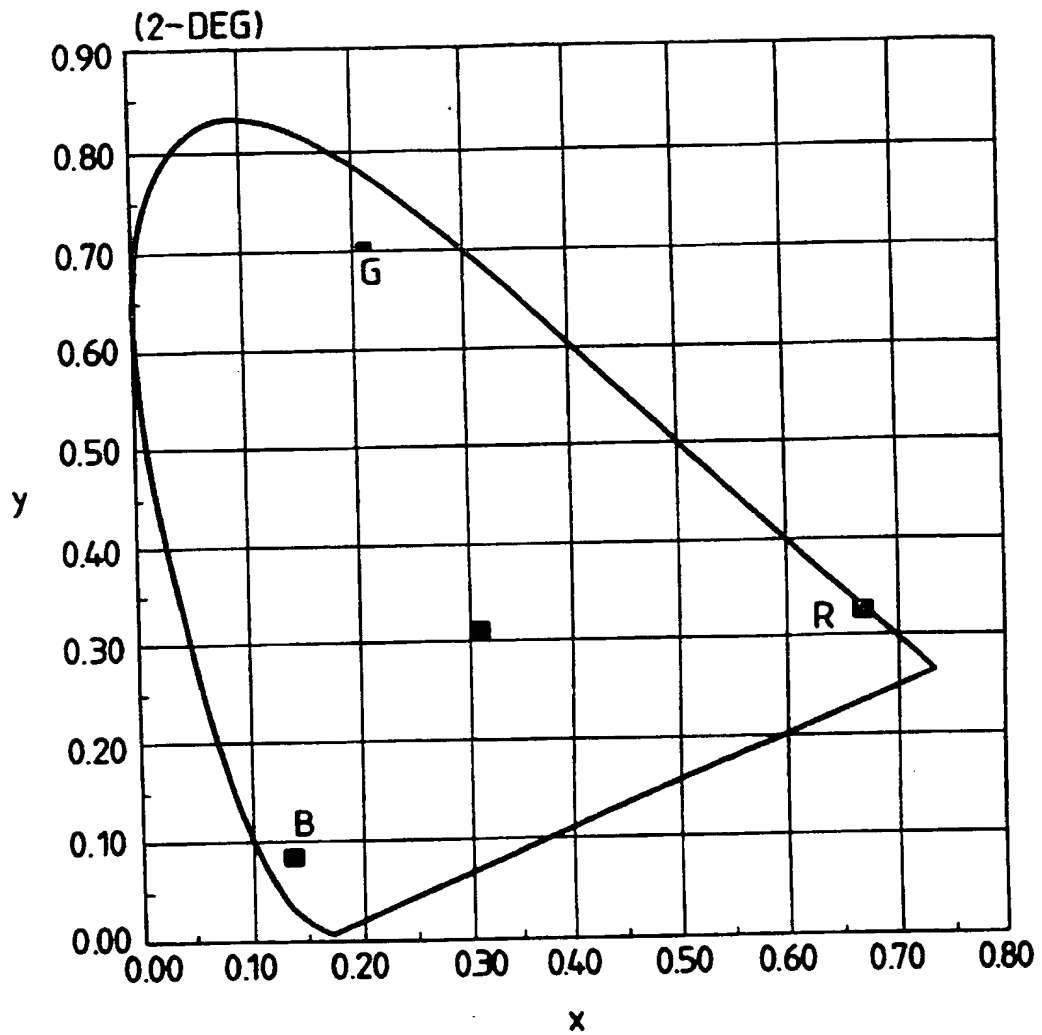


FIG. 7

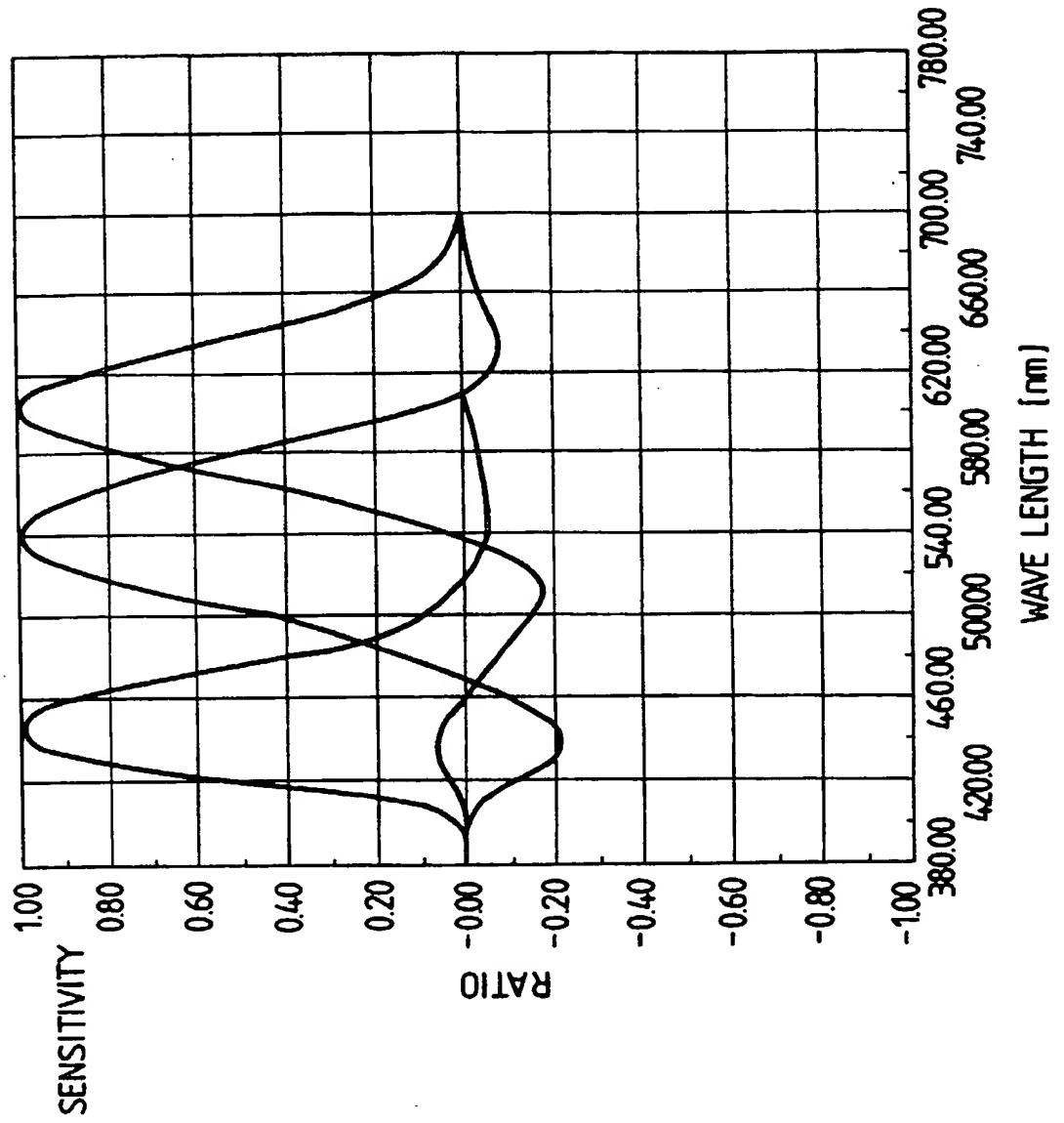


FIG. 8

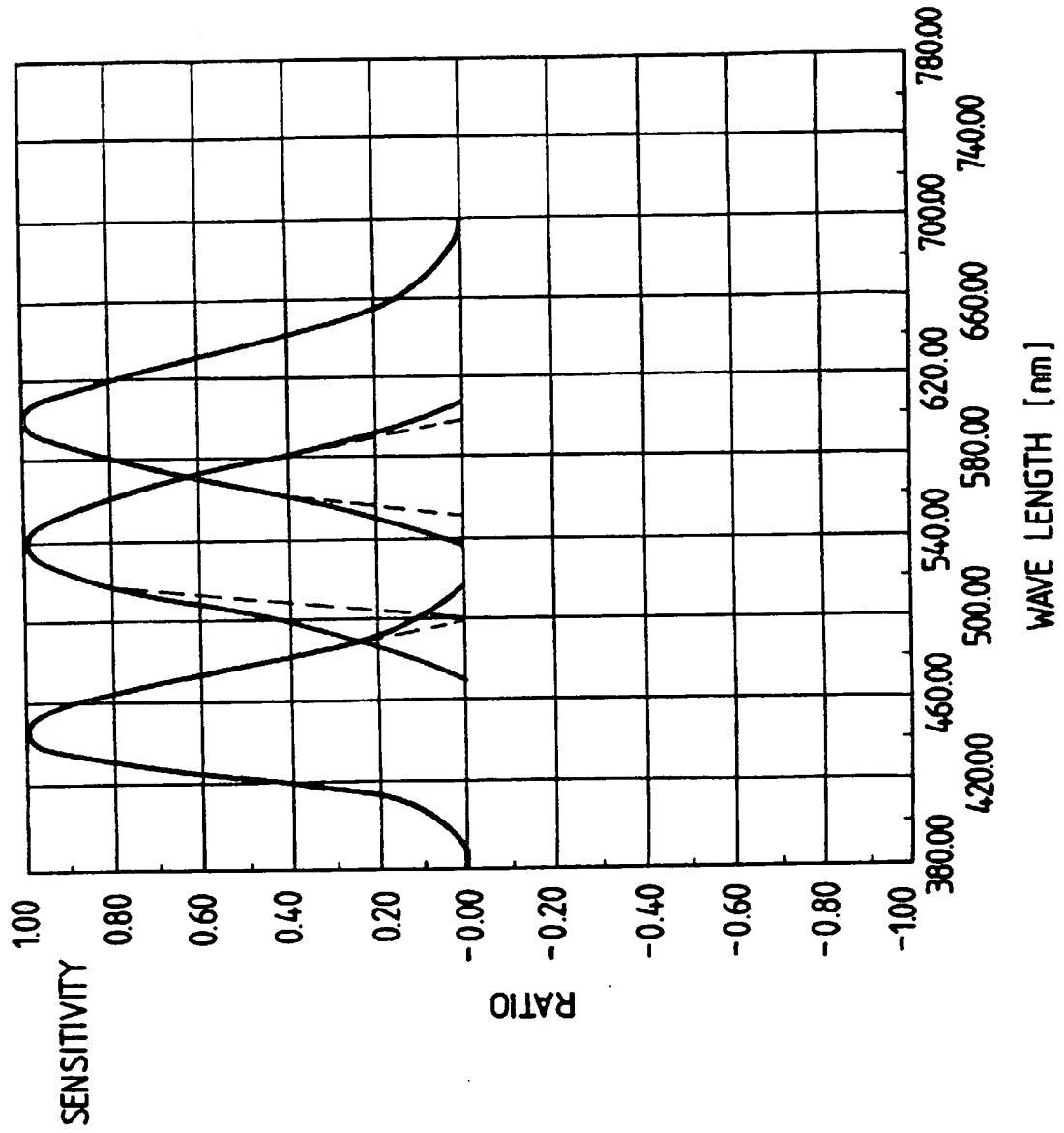


FIG. 9

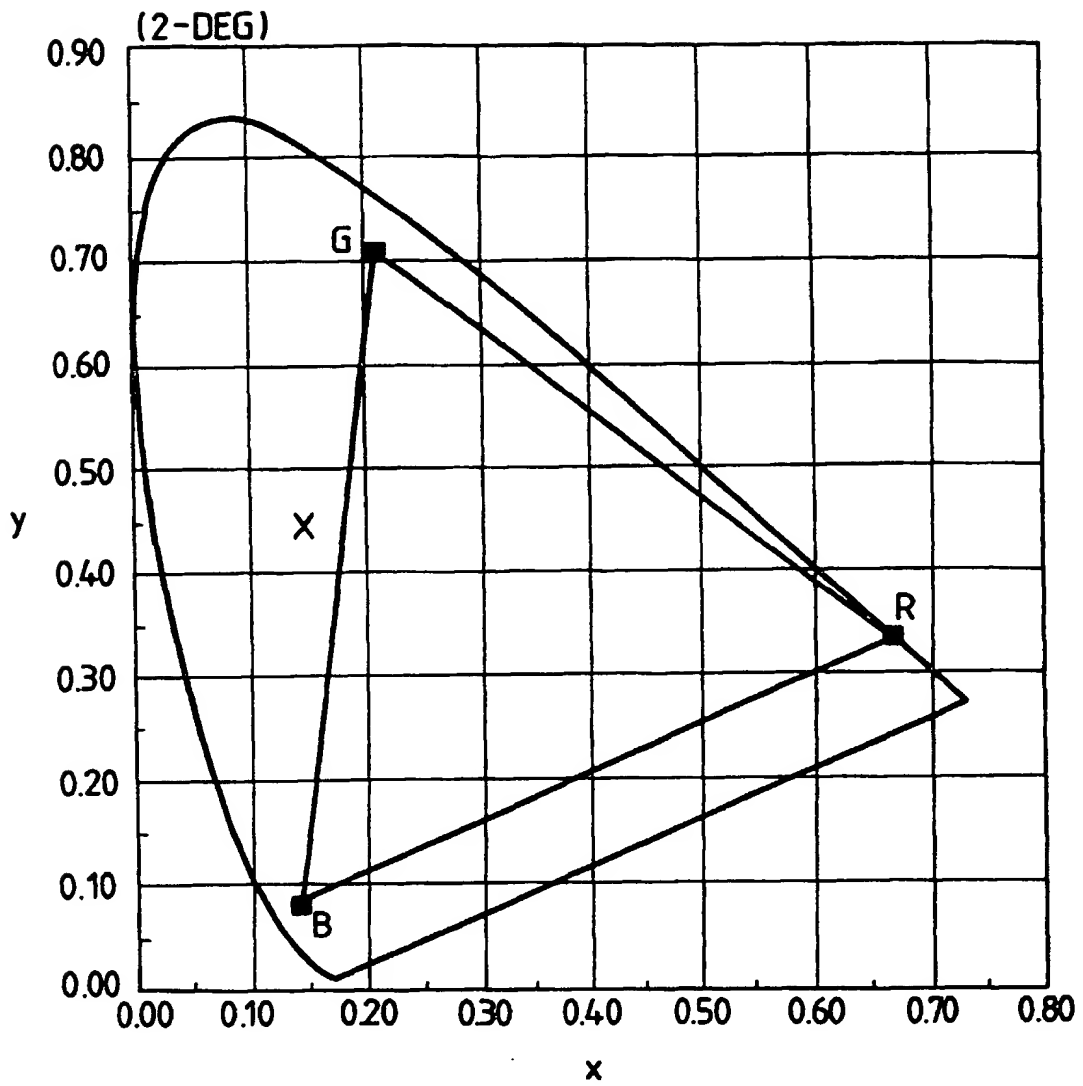


FIG. 10

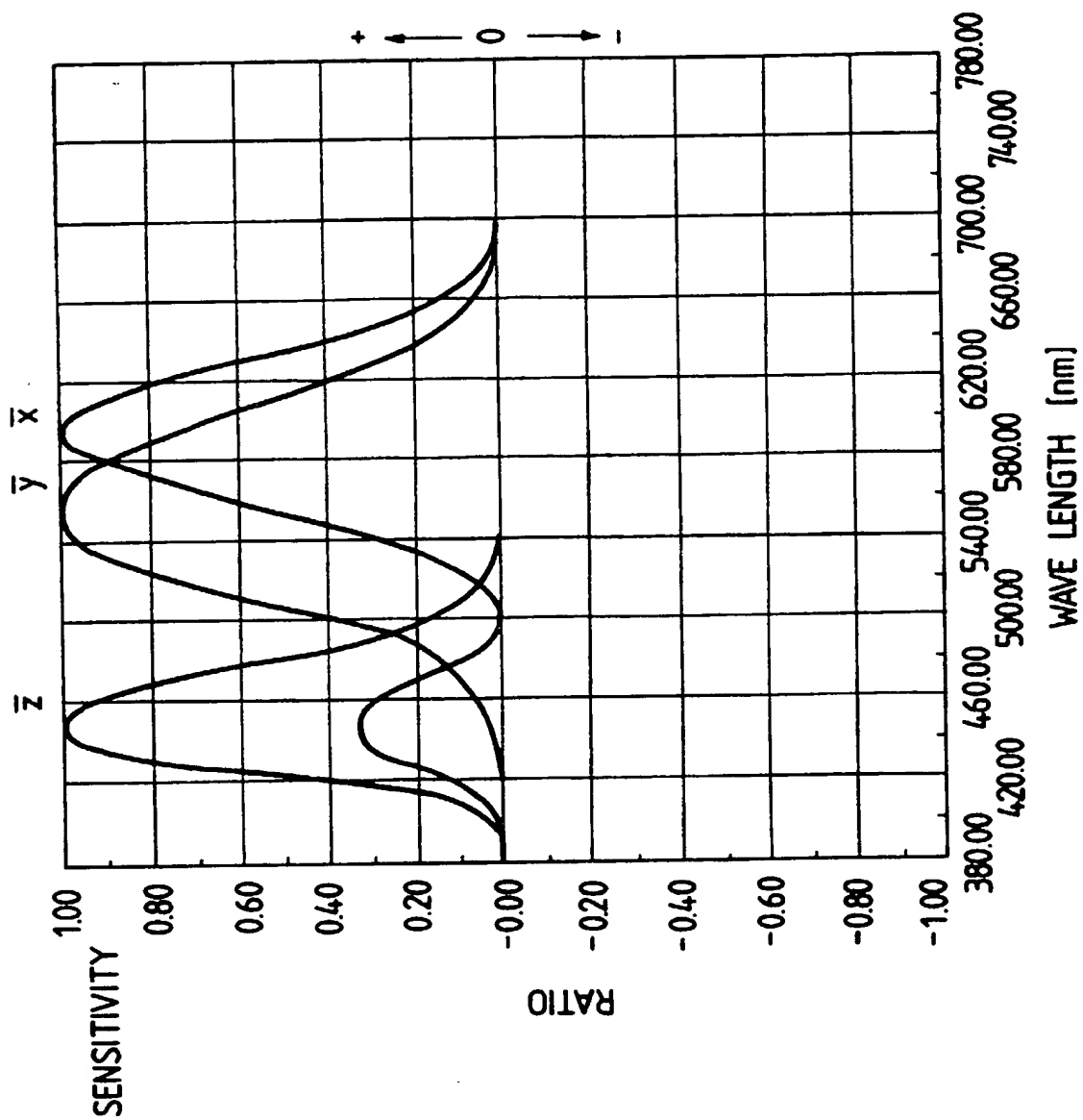


FIG. 11

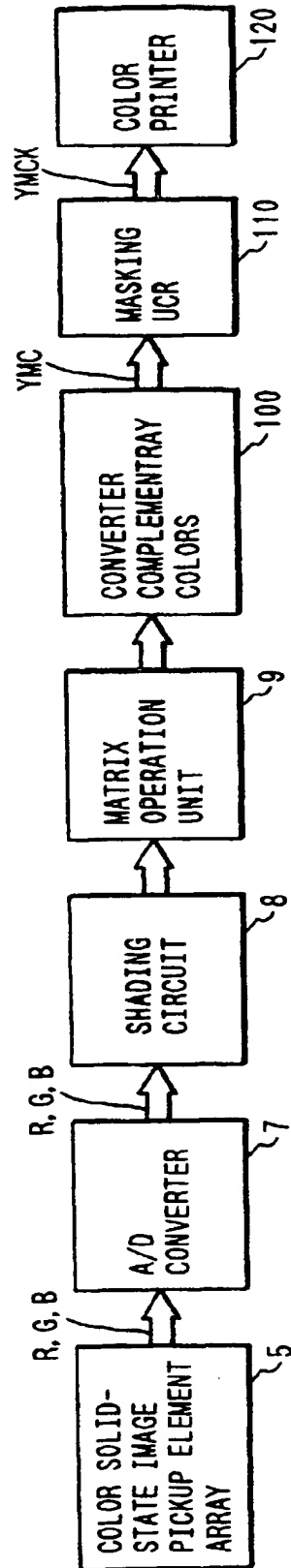


FIG. 12A

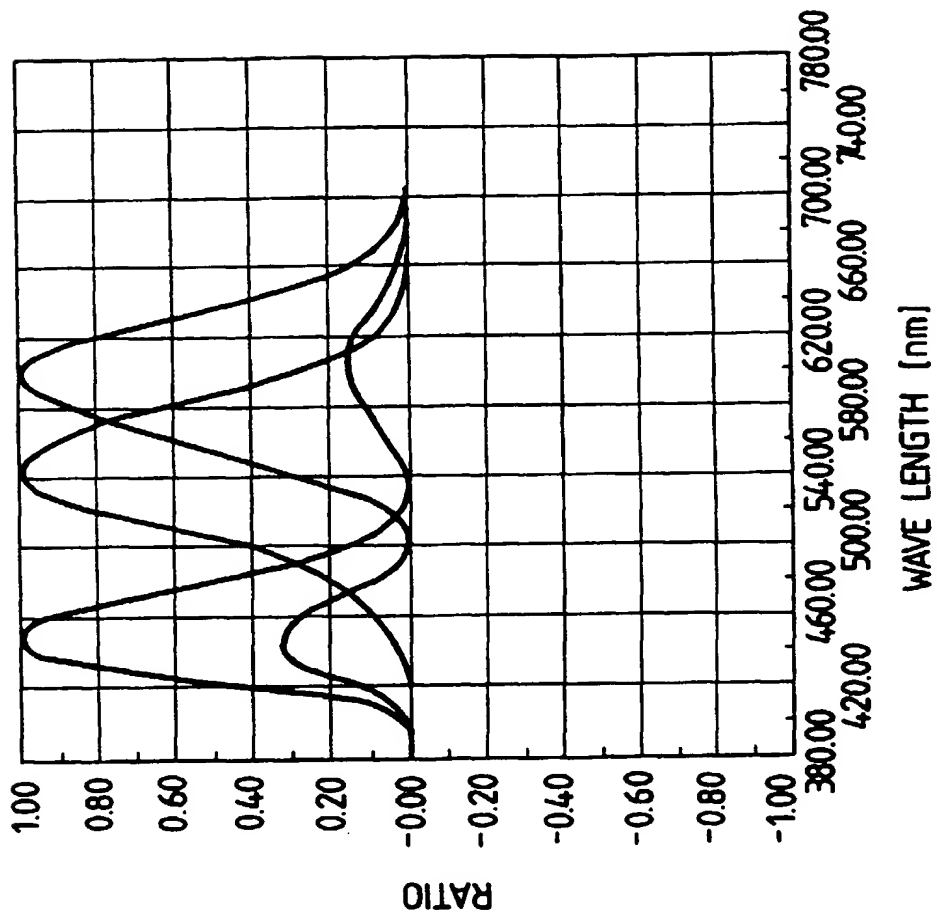


FIG. 12B

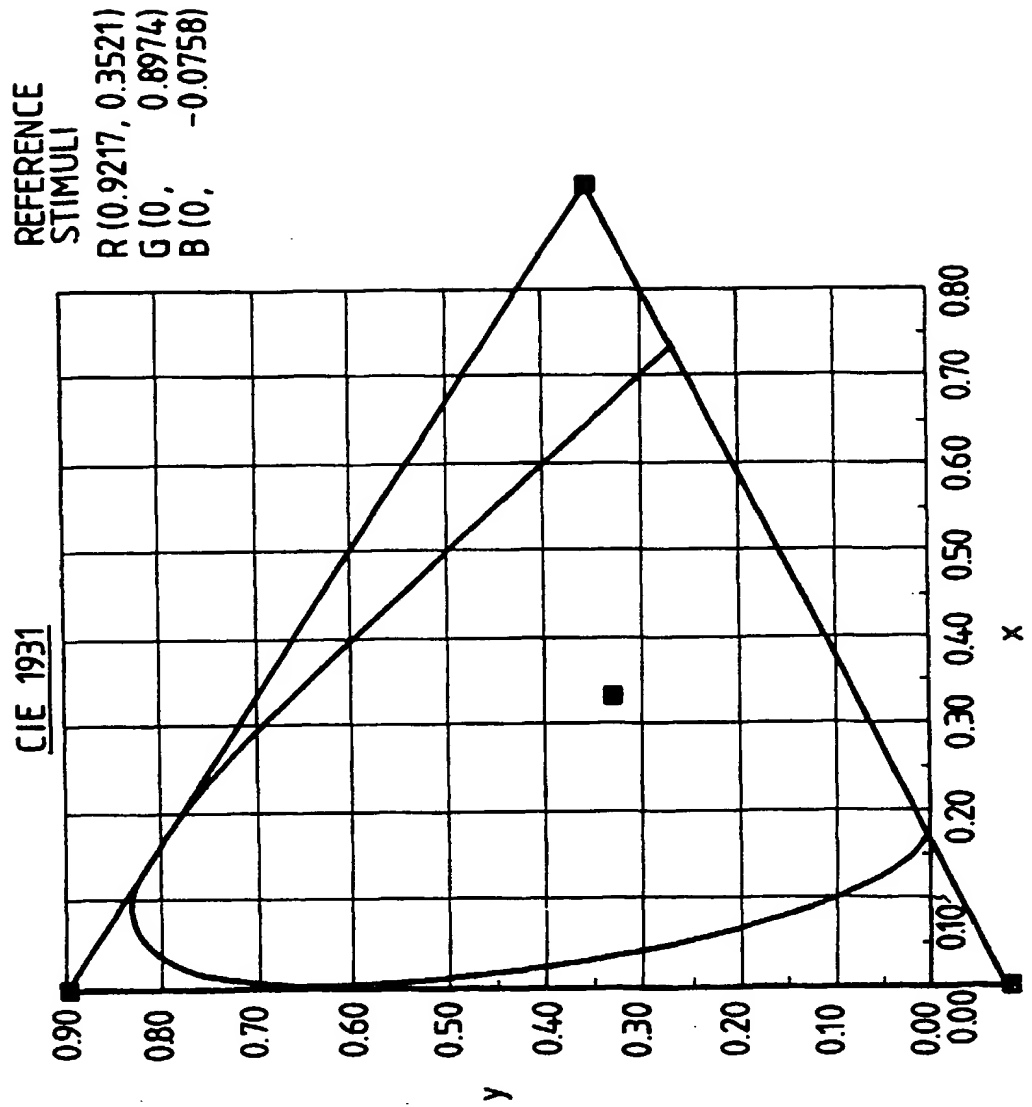
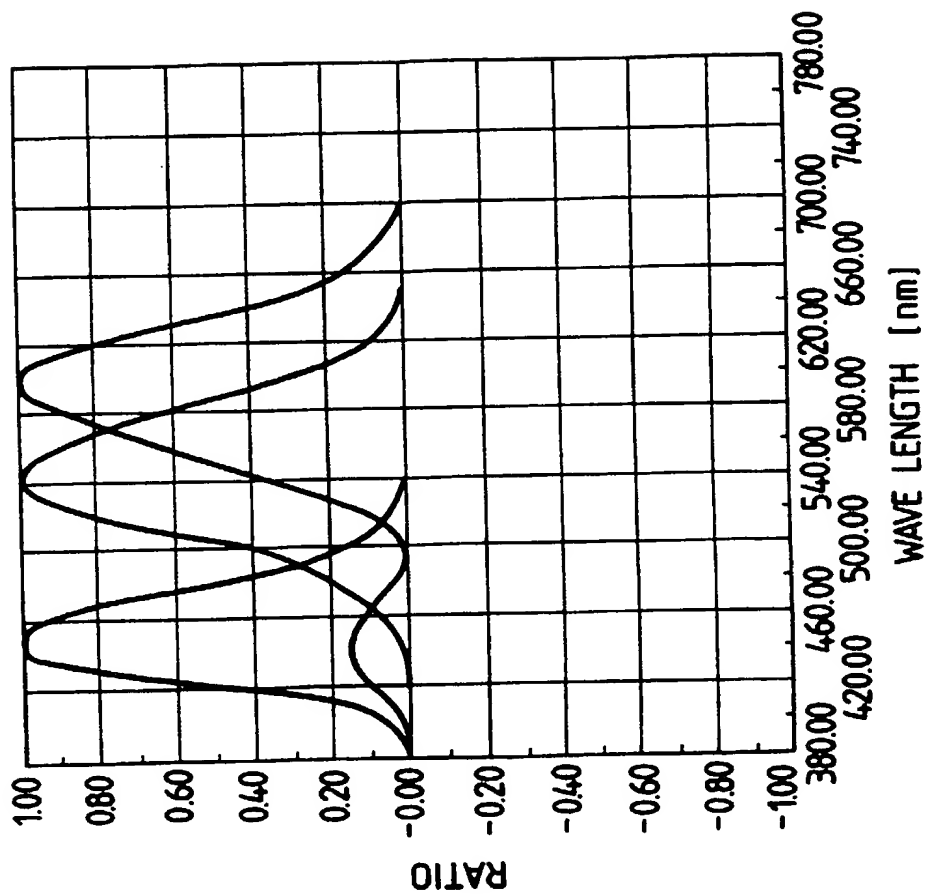


FIG. 13A



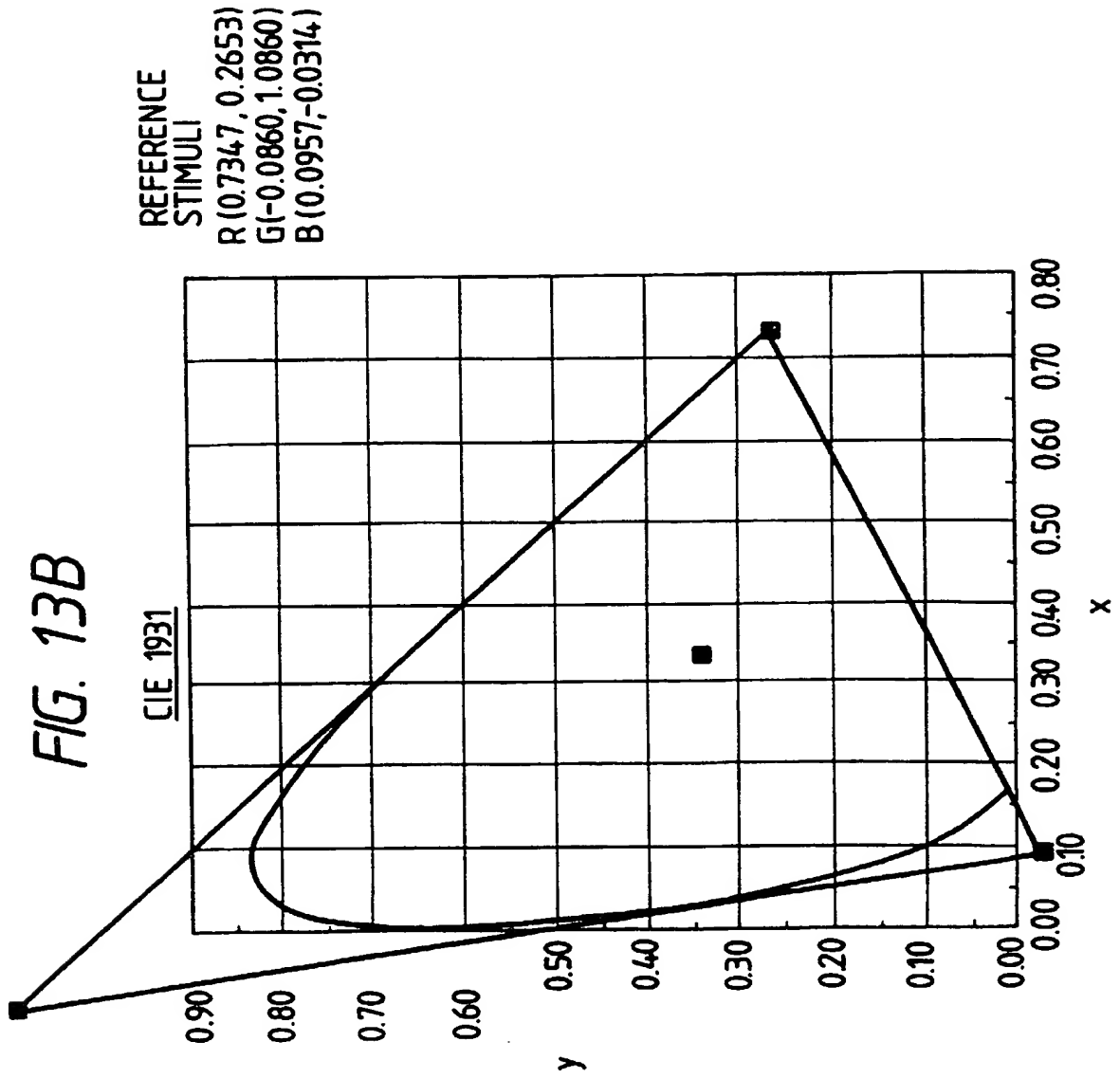


FIG. 14

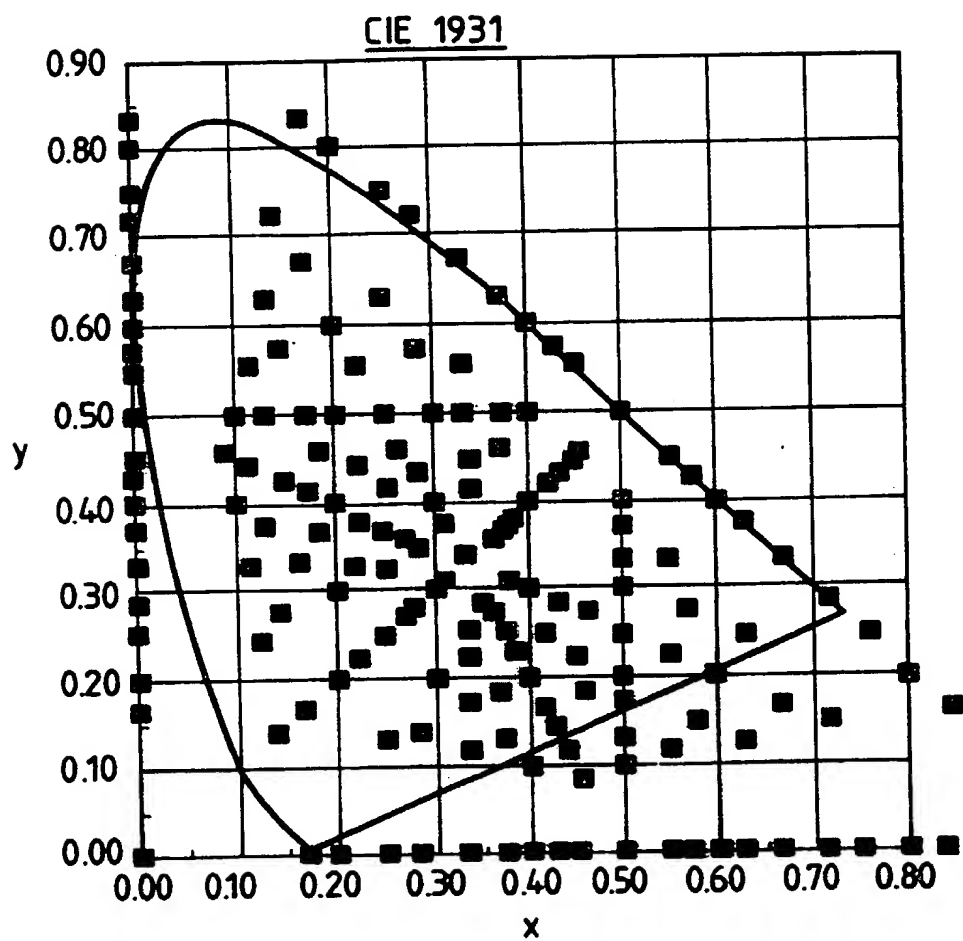


FIG. 15

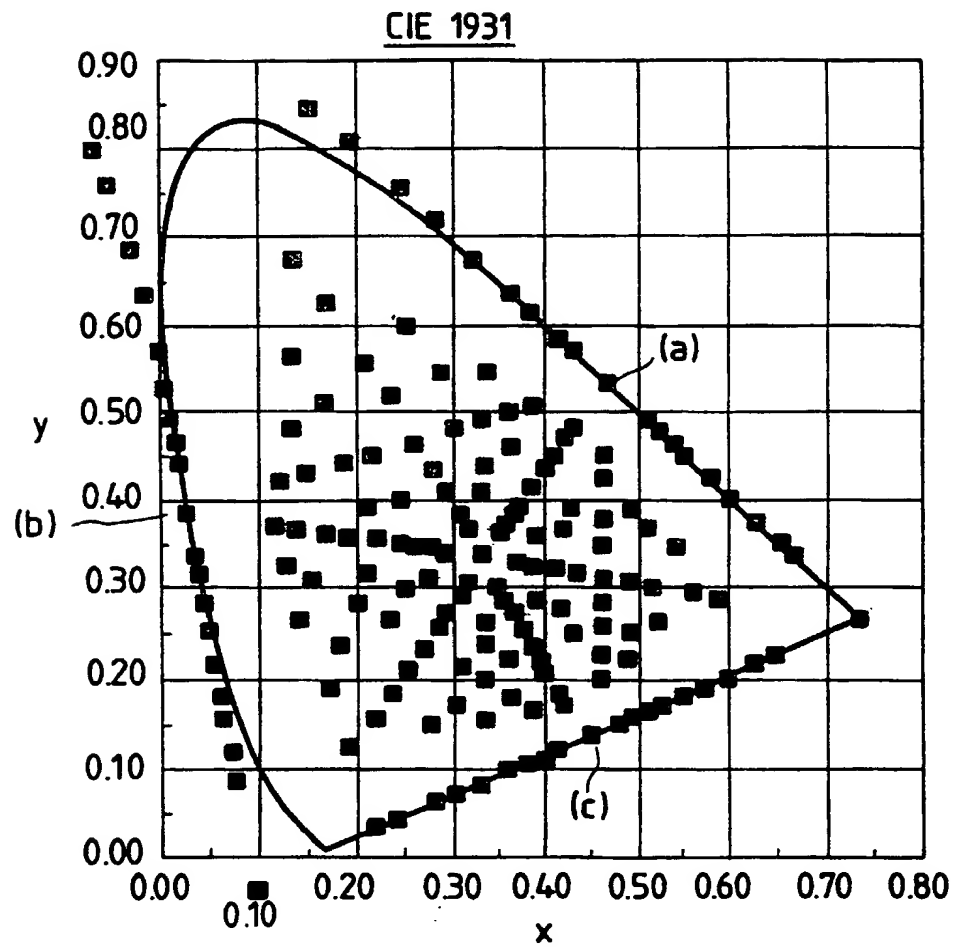


FIG. 16

